Chapter 2: Effects of Bottom Inlet, Baffle Pore Size, and Polyacrylamide on Stilling Basin Performance

Abstract. *Surface water pumped from construction sites frequently contains high levels of turbidity and suspended sediment which is not effectively removed using gravity-based systems. This study assessed the effects of modifying a permanent pool stilling basin with energy dissipaters and with the addition of polyacrylamide (PAM) on turbidity and suspended sediments. Turbidity was generated by injecting soil into flowing water at a fixed rate and mixing for 30 min in a mixing basin. Turbid water containing only suspended sediment was pumped from the surface of the mixing basin to the test basin with physical and chemical treatments. Three energy dissipater treatments were tested: bottom inlet level spreader (BILS; impermeable fabric installed with 40 mm opening from the basin bottom), coir baffles (900 g m^{-2} coir fabric with 0.45 open space fraction (OSF), and Pyramat baffles (synthetic fabric with 0.10 OSF). The tests were run either with or without PAM dosing by passing the flow over a solid PAM block at the stilling basin inlet. A single treatment run included: 30 min adding soil to water flowing into a turbid water source basin, 5 min settling period, 90 min stilling basin filling, and sampling for 40 min once the basin was full. Sampling occurred every 5 min at the basin inlet, basin exit, and six surface and bottom grid points inside the stilling basin. The physical treatments (i.e., energy dissipation) reduced the turbidity and total suspended solids (TSS) of the water exiting the basin by up to 33% and 27%, respectively. The chemical treatment was much more effective regardless of the physical treatment, either in combination or alone, reducing turbidity and TSS up to 88 and 84%, respectively. The BILS enhanced the efficiency of the coir baffles and decreased that of Pyramat baffles in absence of PAM dosing, but had no effect with PAM dosing. The patterns of turbidity and TSS within the basin suggest that only one porous baffle is adequate for PAM-treated water, and that the reduction observed near the outlet was likely floc interception by the sloped wall of the basin outlet. This study provides a relatively simple, inexpensive approach to improving the function of stilling basins for treating turbid water.*

Keywords. *Bottom inlet, level spreader, silt fence, porous baffle, sediment, clay, coir, Pyramat, polyacrylamide.*

INTRODUCTION

Sediment is widely recognized as a leading pollutant of surface waters. In United States alone around 2 billion tons of eroded soil is deposited in water bodies every year (Clark et al., 1985). Construction activities are a major contributor to sedimentation with sediment loads as high as 2000 times that from forested lands to 10-20 times that of agricultural lands (Owen, 1975). Urban erosion related pollutants impose net damage costs that have been estimated to be from $ 192 million to $ 2 billion per year (Clark et al., 1985; Paterson et al., 1993). Suspended solids in surface waters are a serious water quality problem detrimentally affecting aquatic biota, facilitate transport of organic and inorganic pollutants, and decrease the aesthetic value of lakes and rivers (Novotny and Chesters, 1989; Pitt, 1995). Increased suspended sediment reduces the amount of light penetrating the water, harms fish gills, smothers fish eggs, decreases feeding rates of fish, increases water temperature, alters water chemistry, and reduces overall productivity of an aquatic community (Wilber, 1983). The disinfection and clarification processes at water treatment plants is also adversely affected, resulting in increased treatment costs (Le Chevallier et al., 1981).